Selecting the right 3D Printing material

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A quick comparison of all 3D printing materials offered by 3D Hubs.

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Introduction

Selecting a material from the wide range of options available in 3D printing can often be a daunting task. The following article provides a quick overview of the main material groups offered on 3D Hubs along with their general characteristics and design feature specifications.

Material groups

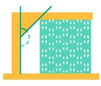
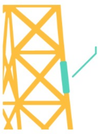
- Prototyping plastics - Affordable, durable and widely available plastics like ABS and PLA.
- High detail resin - Intricate designs and sculptures with a smooth surface finish.
- SLS nylon - Functional prototypes and end-use parts from laser sintered nylon.
- Fiber-reinforced nylon - Engineering parts as strong as metal for the price of plastic.
- Rigid opaque plastic - Realistic prototypes with excellent details and high accuracy.
- Rubber-like plastic - Simulate rubber with various levels of elasticity.
- Transparent plastic - See-through parts and prototypes.
- Simulated polypropylene - Durable prototypes that look and behave like polypropylene.
- Simulated ABS - High precision functional (injection) molds with the toughness of ABS.
- Heat resistant plastic - Thermal resistant prototypes up to 80 C / 176 F.
- Full color sandstone - Photo-realistic full color (scale) models and sculptures.
- Industrial metals - Industrial metals and alloys for prototypes and end-use parts.

Materials overview

Material group	Printing method	Common materials	Cost
Prototyping plastic	FDM	PLA, ABS, PET, Nylon	$
High detail resin	SLA and DLP	Standard, tough & flexible resins	$$
SLS Nylon	SLS	Nylon 12	$$$
Fibre reinforces nylon	FDM	Nylon with carbon, kevlar or fibreglass	$$$
Rigid opaque plastic	Polyjet	Rigid opaque Vero family	$$$$
Rubber-like plastic	Polyjet	Tango family	$$$$
Transparent plastic	Polyjet	VeroClear (RGD810)	$$$$
Simulated Polypropylene	Polyjet	Rigur (RGD450) & Durus (RGD430)	$$$$
Simulated ABS	Polyjet	RGD515 & RGD535	$$$$
Heat resistant plastic	Polyjet	RGD525	$$$$
Full color sandstone	Binder jetting	Sandstone, gypsum	$$$
Industrial metals	SLM, DMLS & EBM	Aluminium, titamium, stainless steel, inconel	$$$$$

Feature specifications

Understanding the limitations of each material group allows a designer to make decision that will result in a better quality print. Below are a table of common 3D printed features.

Feature	Description
	**Wall thickness** - The model's wall must be thick enough to support the model.
	**Supports** - With some technologies each layer needs to build off the last. Because of this there are limitations on build angles and generally support is required to build upon. Supports are not inherently detrimental for your design, but they do add complexity to the printing process and lead to less smooth finish on overhanging parts. More information on supports can be found here.
	**Embossed & engraved detail** - Require a minimum depth, height and width to be visible on a print. If putting text on a design, use a bold sans-serif font for readability, such as Arial Bold.
	**Escape holes** - For some methods of printing escape holes are required to allow excess print material to be removed from hollow sections once the print is completed.
	**Minimum details** - Designs require a minimum detail size so that these features are visible on the print.
	**Minimum feature** - A minimum feature thickness is required to ensure that features are not too small and will fail to print.
	**Moving parts** - Adequate clearance is required between moving parts to reduce the likelihood of binding and improve fit.

The table below presents the feature specifications for each material group. All values are in mm.

Material	Wall thickness	Supports	Embossed & engraved details	Escape holes	Minimum details	Minimum feature	Moving parts
Prototyping plastic	1 - 2	Yes	1 - 2	N/A	0.8	1.2	0.5
High detail resin	0.4 - 0.6	Yes	0.1 - 0.4	1.5 - 3.5	0.2	0.3 - 1	0.5
SLS Nylon	0.8 - 1	No	0.5	2 - 4	0.2	0.8 - 1	0.5
Fibre reinforced nylon	1.6 - 3	Yes	Unable to print	N/A	0.8	1.6 - 3	0.5
Rigid opaque plastic	1	Water soluble	0.5	N/A	0.2	1	0.4
Rubber-like plastic	1	Water soluble	0.5	N/A	0.2	1	0.4
Transparent plastic	1	Water soluble	0.5	N/A	0.2	1	0.4
Simulated Polypropylene	1	Water soluble	0.5	N/A	0.2	1	0.4
Simulated ABS	1	Water soluble	0.5	N/A	0.2	1	0.4
Heat resistant plastic	1	Water soluble	0.5	N/A	0.2	1	0.4
Full color sandstone	2 - 3	No	0.4	1.5 - 2.5	0.4	2 - 3	0.9
Industrial metals	2 - 3	Yes	1	2	1	1 - 3	N/A

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